PATENT ABSTRACTS OF JAPAN

(11)Publication number : 2003-115314

(43)Date of publication of application : 18.04.2003

(51)Int.Cl. H01M 8/04

(21)Application number : 2001-305981

(22)Date of filing : 02.10.2001

(71)Applicant : NISSAN MOTOR CO LTD

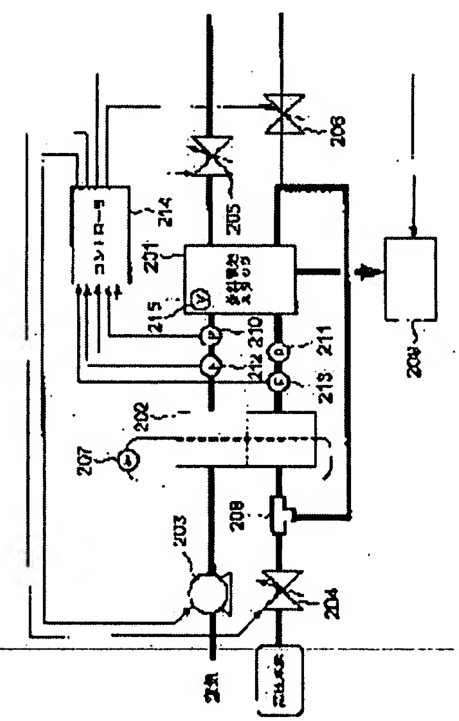
(72)Inventor : AKAHORI KOICHI

(54) CONTROL DEVICE OF FUEL CELL SYSTEM

(57)Abstract:

PROBLEM TO BE SOLVED: To prevent deterioration of fuel consumption due to purges, and the purges are appropriately made to be enabled in a failure of cell voltage detecting means.

SOLUTION: A controller 214 actuates the purge valve 206 corresponding to the cell voltage status detected by the cell voltage detecting means 215, and actuates the purge valve 206 at a prescribed interval corresponding to the cell voltage status detected by the cell voltage detecting means 215 in the failure of the cell voltage detecting means 215.



LEGAL STATUS

[Date of request for examination]	25.12.2002
[Date of sending the examiner's decision of rejection]	
[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]	
[Date of final disposal for application]	
[Patent number]	3731517
[Date of registration]	21.10.2005

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

CLAIMS

[Claim(s)]
[Claim 1] The cel which is made to carry out electrochemical reaction of fuel gas and the oxidation gas, and obtains power, and a purge means to purge at least one side of the fuel gas path in a cel, and an oxidation gas passageway, In the control unit of the fuel cell system equipped with a cel electrical-potential-difference detection means to detect the electrical potential difference of a cel group which consists of a single cel or two or more cels, and the purge control means which operates a purge means according to the condition of the detected cel electrical potential difference A purge control means is the control unit of the fuel cell system characterized by operating a purge means at the predetermined spacing at the time of fail of the above-mentioned cel electrical-potential-difference detection means.
[Claim 2] The operating time of said purge means is the control unit of the fuel cell system according to claim 1 characterized by what it opts for based on the operational status of a fuel cell.
[Claim 3] The operational status of said fuel cell is the control unit of the fuel cell system according to claim 2 which is in the load of a fuel cell, a quantity of gas flow, and at least one or more conditions of gas pressure, and is characterized by lengthening said operating time, so that these values are small.
[Claim 4] Said predetermined spacing is the control unit of the fuel cell system according to claim 1 to 3 characterized by what it opts for based on the operational status of a fuel cell.
[Claim 5] The operational status of said fuel cell is the control unit of the fuel cell system according to claim 4 which is in the load of a fuel cell, a quantity of gas flow, and at least one or more conditions of gas pressure, and is characterized by making said predetermined spacing small, so that these values are small.
[Claim 6] Said purge control means is the control unit of the fuel cell system according to claim 1 or 2 characterized by making into said predetermined spacing actuation spacing which memorized actuation spacing of the purge means of the forward always of the above-mentioned cel electrical-potential-difference detection means, and was memorized at the time of fail of the above-mentioned cel electrical-potential-difference detection means.
[Claim 7] The control unit of the fuel cell system according to claim 6 characterized by making into said predetermined spacing actuation spacing memorized by the last among actuation spacing by which storage was carried out [above-mentioned].
[Claim 8] The control unit of the fuel cell system according to claim 6 characterized by making shortest actuation spacing into said predetermined spacing among actuation spacing by which storage was carried out [above-mentioned].
[Claim 9] Said purge control means memorizes the operational status of the fuel cell at the time of the purge means actuation concerned while memorizing actuation spacing of the purge means of the forward always of the above-mentioned cel electrical-potential-difference detection means. The control unit of the fuel cell system according to claim 6 characterized by making actuation spacing memorized at the time of the operational status nearest to the operational status of a current fuel cell among memorized actuation spacing into said predetermined spacing at the time of fail of the above-mentioned cel electrical-potential-difference detection means.
[Claim 10] The data which in setting up the above-mentioned predetermined spacing were memorized just before being judged with the time of fail of the above-mentioned cel electrical-potential-difference detection means among said memorized actuation spacing are the control unit of the fuel cell system according to claim 6 to 9 characterized by what is not taken into consideration.

[Translation done.]

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to a fuel cell system, especially relates to purge control.
[0002]
[Description of the Prior Art] In a fuel cell, the water which fuel gas (hydrogen gas) is consumed by the anode (anode plate) side, and is generated by the cathode (cathode) side of a cel is accumulated in the cell of a cel. Moreover, impurities, such as nitrogen contained in fuel gas (hydrogen gas) or oxidation gas (air), are also accumulated. If these water and an impurity are accumulated, performance degradation -- the generated output of a cel declines -- will happen.
[0003] Then, in order to perform purge actuation which removes water, an impurity, etc. like JP,2000-215905,A, there is the approach of carrying out atmospheric-air disconnection of the gas passageway at fixed spacing (conventional example 1).
[0004] Moreover, when detecting the fall of a cel electrical potential difference like JP,2000-243417,A since the fall of a cel electrical potential difference takes place if an impurity is accumulated into a cell while purging for every fixed time amount, there is the approach of purging (conventional example 2).
[0005]
[Problem(s) to be Solved by the Invention] Although accompanied by side effects, such as a temporary fall of emission of a fuel, or the amount of generations of electrical energy, with removal of water, an impurity, etc. in a purge, since it may purge in spite of accumulating neither water nor an impurity in fact, since it purges periodically, it becomes aggravation of fuel consumption in the conventional example 1.
[0006] moreover -- there is no fall of a cel electrical potential difference also in the conventional example 2 -- ** -- since it purges, and it may purge in spite of accumulating neither water nor an impurity in the actual condition when fixed time amount progress is carried out, it becomes aggravation of fuel consumption.
[0007]
[Means for Solving the Problem] The cel which is made to carry out electrochemical reaction of fuel gas and the oxidation gas, and obtains power in the 1st invention in order to solve the above-mentioned technical problem, A cel electrical-potential-difference detection means to detect the electrical potential difference of a cel group which consists of a purge means to purge at least one side of the fuel gas path in a cel, and an oxidization gas passageway, a single cel, or two or more cels, It set to the control device of the fuel cell system equipped with the purge control means which operates a purge means according to the condition of the detected cel electrical potential difference, and the purge control means was considered as the configuration which operates a purge means at the predetermined spacing at the time of fail of a cel electrical-potential-difference detection means.
[0008] In the 2nd invention, operating time of a purge means was taken as the configuration for which it opts based on the operational status of a fuel cell.
[0009] In the 3rd invention, the operational status of a fuel cell was in the load of a fuel cell, a quantity of gas flow, and at least one or more conditions of gas pressure, and it was considered as the configuration which lengthens operating time, so that these values were small.
[0010] In the 4th invention, predetermined spacing was considered as the configuration for which it opts based on the operational status of a fuel cell.
[0011] In the 5th invention, the operational status of a fuel cell was in the load of a fuel cell, a quantity of gas flow, and at least one or more conditions of gas pressure, and it was considered as the configuration which makes predetermined spacing small, so that these values were small.
[0012] In the 6th invention, the purge control means memorized actuation spacing of the purge means of the forward always of a cel electrical-potential-difference detection means, and considered it as the configuration which makes

predetermined spacing memorized actuation spacing at the time of fail of a cel electrical-potential-difference detection means.

[0013] In the 7th invention, it considered as the configuration which makes predetermined spacing actuation spacing memorized by the last among memorized actuation spacing.

[0014] In the 8th invention, it considered as the configuration which makes shortest actuation spacing predetermined spacing among memorized actuation spacing.

[0015] A purge control means memorized the operational status of the fuel cell at the time of the purge means actuation concerned while having memorized actuation spacing of the purge means of the forward always of a cel electrical-potential-difference detection means, and in the 9th invention, it considered it as the configuration which makes predetermined spacing actuation spacing memorized at the time of the operational status nearest to the operational status of a current fuel cell among memorized actuation spacing at the time of fail of a cel electrical-potential-difference detection means.

[0016] In setting up predetermined spacing, in the 10th invention, the data memorized among memorized actuation spacing just before fail were considered as the configuration which is not taken into consideration.

[0017]

[Effect of the Invention] According to the 1st invention, since a purge means is operated according to the condition of a cel electrical potential difference while a cel electrical-potential-difference detection means is normal, it purges, in spite of accumulating neither water nor an impurity in fact, and prevents worsening fuel consumption. Both, at the time of fail of a cel electrical-potential-difference detection means, by operating a purge means at the predetermined spacing, even if it is at the fail time of a cel electrical-potential-difference detection means, water and an impurity can be removed.

[0018] Moreover, although the ease of removing of the ease of purging, i.e., water, and an impurity was dependent on the operational status of fuel cells, such as a load of a fuel cell, a quantity of gas flow, and gas pressure, since it determined the operating time of a purge means in the 2nd invention based on operational status, it is hard to accumulate water and an impurity, and is lost, and the degradation of a fuel cell stack can be prevented effectively.

[0019] When the load of a fuel cell, a quantity of gas flow, and gas pressure are small, even if it performs purge actuation especially, since the rate of flow of gas is slow, the effectiveness of a purge is small. Then, according to the 3rd invention, by lengthening time amount to purge, water and the impurity which were accumulated can become are easy to be removed, the effectiveness of a purge can be heightened, and the degradation of a fuel cell stack can be more effectively prevented, so that these values are small.

[0020] Moreover, although the generating / are recording ease of carrying out of the need for a purge, i.e., water, and an impurity was dependent on the operational status of fuel cells, such as a load of a fuel cell, a quantity of gas flow, and gas pressure, in order to purge by deciding predetermined spacing based on operational status in the 4th invention, it is hard to accumulate water and an impurity, and is lost, and the degradation of a fuel cell stack can be prevented effectively.

[0021] When the load of a fuel cell, a quantity of gas flow, and gas pressure are small, water and an impurity are especially easy to be accumulated into a septum. Then, in order according to the 5th invention to purge at short spacing so that these values were small, water and an impurity become is hard to be accumulated, and it can perform preventing the degradation of a fuel cell stack more effectively.

[0022] It can control purging vainly, preventing that can purge at suitable spacing even if it is at the fail time of a cel electrical-potential-difference detection means, and water and an impurity are accumulated into a cell by memorizing actuation spacing of the purge means of the forward always of a cel electrical-potential-difference detection means according to the 6th invention.

[0023] Since possibility that the time of memorizing and the present operational status approximate by purging at intervals of the actuation memorized at the end is high according to the 7th invention, possibility that it can purge at more suitable spacing increases.

[0024] According to the 8th invention, water and an impurity can prevent being accumulated into a cell certainly by purging at intervals of the shortest actuation of the memorized inside.

[0025] According to the 9th invention, according to operational status, it can depend by memorizing operational status also at the time of fail of a cel electrical-potential-difference detection means with actuation spacing, and can purge at suitable spacing.

[0026] According to the 10th invention, the data in front of unreliable fail can be purged at more suitable spacing by not using.

[0027]

[Embodiment of the Invention] The fuel cell system which applied this invention to drawing 1 is shown.
[0028] 201 is a fuel cell stack which consists of two or more cels. 202 is a humidifier. 203 is a compressor and sends the compressed air to a fuel cell stack. 204 is an adjustable bulb, adjusts the pressure of high-pressure hydrogen and adjusts the flow rate of the hydrogen which flows to a fuel stack. 205 is a throttle and adjusts the flow rate of the humidified compressed air which is supplied to a fuel cell stack. 206 purges by exhausting the water accumulated in the fuel cell stack, and an impurity while exhausting to the exterior the hydrogen which circulates by the purge valve as a purge means. 207 is a pure water pump and sends pure water into a humidifier. 208 is an ejector and circulates the hydrogen gas discharged from the fuel cell stack. 209 is a drive unit (load) using the generation-of-electrical-energy force of a fuel cell. 210 is a sensor which measures the pressure of oxidation gas (air). 211 is a sensor which measures the pressure of fuel gas (hydrogen). 212 is a sensor which measures the flow rate of oxidation gas. 213 is a sensor which measures the flow rate of fuel gas. 214 is a controller which controls a throttle 205, a compressor 203, and the adjustable bulb 204 by considering the pressure of fuel gas, the pressure of a flow rate and oxidization gas, and a flow rate as an input, and drives a purge valve 206 as a purge control means so that it may become the amount of target generations of electrical energy. 215 is a cel electrical-potential-difference sensor which measures the cel electrical potential difference of a fuel cell stack. Although the cel electrical-potential-difference sensor 215 is writing only one to drawing for convenience, it has it for every cel group which consists of every single cels of all in a fuel cell stack, and two or more cels.
[0029] The control flow chart about the 1st operation gestalt of this invention is shown in drawing 2 . This flow chart is performed repeatedly every 10ms.
[0030] A cel electrical potential difference is detected at step S301. At step S302, it judges whether the cel electrical-potential-difference sensor 215 is normal, if normal, it will progress to step S303, and if unusual, it will progress to step S306.
[0031] In order to judge whether the cel electrical-potential-difference sensor 215 is functioning normally, suppose that the values which a cel voltage monitor value usually shows are V1-V2 (V1<V2). In being normal, the voltage monitor value is contained within the limits of this, but when the cel electrical-potential-difference sensor 215 has been disconnected, it points to an electrical potential difference lower than V1, or points to an electrical potential difference higher than V2. When such a condition continues predetermined time, it can be judged that the cel voltage sensor was disconnected. Moreover, it is detectable by the approach with same it being short etc. to the short-circuit and ground line to power-source Rhine.
[0032] At step S303, it judges whether there is any cel to which the cel electrical potential difference is falling; if there is a fall cel, it will progress to step S304, and if there is nothing, it will progress to step S305 and a purge valve 206 will be closed.
[0033] Since possibility that water and an impurity have accumulated on a fuel stack is high, it opens a purge valve 206 at step S304 that there is a cel to which the cel electrical potential difference is falling.
[0034] At step S306, if the condition of a purge valve 206 is judged and closed and it is [it is progressing to step S307 and] open, it will progress to step S309.
[0035] At step S307, if it judges whether predetermined time (t1) progress is carried out and predetermined time (t1) progress is carried out after a purge valve 206 closes, it will progress to step S308 and a purge valve 206 will be opened. How to decide predetermined time (t1) is mentioned later. In addition, this predetermined time (t1) is equivalent to "predetermined spacing" of claim 1.
[0036] At step S309, if it judges whether predetermined time (t2) progress is carried out and predetermined time (t2) progress is carried out after a purge valve opens, it will progress to step S310 and a purge valve will be closed. How to decide predetermined time (t2) is mentioned later. In addition, this predetermined time (t2) is equivalent to "operating time" of claim 2.
[0037] The control flow chart (A) about a setup of predetermined time (t1) and the control flow chart (B) about a setup of predetermined time (t2) are shown in drawing 3 . Step S401 The flow rate of hydrogen gas is detected in A and S401B. A map as shown in drawing 4 from a hydrogen quantity of gas flow is searched with step S402A, a map as shows predetermined time (t1) to drawing 5 by step S402B is searched, and predetermined time (t2) is found.
[0038] In order to make predetermined time (t1) small and to purge at short spacing so that the flow rate of hydrogen gas was small as shown in drawing 4 since it was in the inclination which water and an impurity tend to generate and accumulate so that the flow rate of hydrogen gas is small, it is hard to accumulate water and an impurity, they are lost, and can prevent the degradation of a fuel cell stack effectively.
[0039] moreover When the flow rate of hydrogen gas is small, even if it performs purge actuation, since the rate of flow of gas is slow By lengthening time amount which enlarges predetermined time (t2) and purges it, so that the flow

rate of hydrogen gas is small as shown in drawing 5 since the effectiveness of a purge is small Water and the impurity which were accumulated can become are easy to be removed, the effectiveness of a purge can be heightened, and the degradation of a fuel cell stack can be prevented more effectively.

[0040] In addition, although the flow rate of hydrogen gas was used for the setup of predetermined time (t1) and predetermined time (t2) here, you may make it ask from the operational status of not only this but other fuel cells, for example, the load of a fuel cell, gas pressure, etc. Moreover, not map retrieval but a formula may be used.

[0041] Next, the 2nd operation gestalt is explained. Unlike the 1st operation gestalt, other control has [the 2nd operation gestalt] the same setting approach of purge spacing at the time of fail of predetermined time (t1), i.e., a cel electrical-potential-difference detection means.

[0042] The control flow chart about a setup of the predetermined time (t1) in the 2nd operation gestalt of this invention is shown in drawing 6 . This flow is a thing of the control flow chart (A) of drawing 3 in the 1st operation gestalt instead performed.

[0043] At step S601, it judges whether the cel electrical-potential-difference sensor 215 is normal, if normal, it will progress to step S602, and if it is fail, it will progress to step S604. At step S602, if it judges whether the purge was started and purge initiation is carried out, it will progress to step S603, otherwise, will end. It memorizes at step S603, the time amount, i.e., purge spacing, to this purge initiation from the last purge initiation. Let purge spacing memorized at step S603 be predetermined time (t1) at step S604.

[0044] Since it can purge at the same spacing as having been carried out to always [forward] by performing such control at the time of fail of an electrical-potential-difference detection means, a purge will be performed at suitable spacing.

[0045] While becoming saving of memory space here if it is the configuration which memorizes only the newest purge spacing in case purge spacing is memorized at step S603, possibility that the operational status when memorizing the time of subsequent fail generating approximates becomes high, and possibility that it can depend according to operational status also at the time of fail, and can purge at suitable spacing increases.

[0046] Moreover, in case purge spacing is memorized at step S603, even if it will be in the condition that operational status is accumulated after fail generating and water and an impurity are easy to be accumulated into a cell, by making into predetermined time (t1) the shortest thing in purge spacing which memorizes the hysteresis of purge spacing and is memorized at step S604, these are recording can prevent certainly.

[0047] By the way, if it is made for possibility that purge spacing memorized just before judging that a cel electrical-potential-difference detection means is unusual is unreliable data not to take into consideration the data memorized among memorized purge spacing at step S603 just before fail generating since it was high, precision will improve further.

[0048] In addition, in case purge spacing is memorized at step S603, storage is not always updated for every purge initiation, but control equivalent to making the shortest thing of the memorized inside into predetermined time (t1) can be performed, saving memory space, if it is the configuration updated only when it becomes shorter than purge spacing memorized.

[0049] Next, the 3rd operation gestalt is explained. Unlike the 1st and 2nd operation gestalt, other control has [the 3rd operation gestalt] the same setting approach of purge spacing at the time of fail of predetermined time (t1), i.e., a cel electrical-potential-difference detection means.

[0050] The control flow chart about a setup of the predetermined time (t1) in the 3rd operation gestalt of this invention is shown in drawing 7 . This flow is a thing of the control flow chart (A) of drawing 3 in the 1st operation gestalt, and the control flow chart of drawing 6 in the 2nd operation gestalt instead performed.

[0051] At step S701, operational status (the load of a fuel cell, a quantity of gas flow, gas pressure, etc.) is detected. At step S702, it judges whether a cel electrical-potential-difference detection means is normal, if normal, it will progress to step S703, and if unusual, it will progress to step S705. At step S703, if it judges whether the purge was started and purge initiation is carried out, it will progress to step S704, otherwise, will end. At step S704, purge spacing is memorized with operational status. At step S705, purge spacing memorized at the time of the operational status nearest to current operational status is set as predetermined time (t1).

[0052] Thus, according to operational status, it can depend also at the time of fail of a cel electrical-potential-difference detection means by setting up predetermined time (t1), and can purge at suitable spacing.

[0053] By the way, if it is made for possibility that purge spacing memorized just before judging that a cel electrical-potential-difference detection means is unusual is unreliable data not to take into consideration the data memorized among memorized purge spacing at step S705 just before fail generating since it was high, precision will improve further.

[Translation done.]